PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 22 February 2001 (22.02.01)	
International application No.: PCT/GB00/02794	Applicant's or agent's file reference: C295.01/I
International filing date: 20 July 2000 (20.07.00)	Priority date: 14 August 1999 (14.08.99)
Applicant: DOUBLE, Julie, Caroline et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

17 November 2000 (17.11.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

KEITH W. NASH & CO.
90-92 Regent Street
Cambridge CB2 1DP
GRANDE BRETAGNE

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	28.11.2001
Applicant's or agent's file reference HCM/C295.01/I	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02794	20/07/2000	14/08/1999

Applicant
IMPERIAL CHEMICAL INDUSTRIES PLC et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Garry, A Tel.+49 89 2399-2375

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* C295.01/I

Box No. I TITLE OF INVENTION

Improvements in or relating to thermal transfer printing

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Imperial Chemical Industries PLC
Imperial Chemical House
Millbank
London, SW1P 3JF
United Kingdom

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

DOUBLE, Julie Caroline

39 Lanercost Way
Ipswich
Suffolk, IP2 9DL
United Kingdom

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Keith W Nash & Co,
90-92 Regent Street
Cambridge
CB2 1DP
United Kingdom

Telephone No. (01223) 355477

Facsimile No. (01223) 324353

Teleprinter No

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

CLIFTON, Andrew
1 Norwich Road
Claydon
Ipswich, IP6 0DQ
United Kingdom

This person is:
- [ ] applicant only
- [x] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [x] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

BUTTERS, Alan
17 Mowlands
Capel St Mary
Suffolk, IP9 2XB
United Kingdom

This person is:
- [ ] applicant only
- [x] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [x] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

- [ ] Further applicants and/or (further) inventors are indicated on another continuation sheet

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☐ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☐ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☐ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☐ **AE** United Arab Emirates
☐ **AL** Albania .....
☐ **AM** Armenia .....
☐ **AT** Austria .....
☐ **AU** Australia .....
☐ **AZ** Azerbaijan
☐ **BA** Bosnia and Herzegovina .....
☐ **BB** Barbados
☐ **BG** Bulgaria .....
☐ **BR** Brazil .....
☐ **BY** Belarus .....
☐ **CA** Canada
☐ **CH and LI** Switzerland and Liechtenstein
☐ **CN** China .....
☐ **CR** Costa Rica .....
☐ **CU** Cuba .....
☐ **CZ** Czech Republic .....
☐ **DE** Germany .....
☐ **DK** Denmark .....
☐ **DM** Dominica
☐ **EE** Estonia .....
☐ **ES** Spain .....
☐ **FI** Finland .....
☐ **GB** United Kingdom
☐ **GD** Grenada
☐ **GE** Georgia .....
☐ **GH** Ghana .....
☐ **GM** Gambia
☐ **HR** Croatia .....
☐ **HU** Hungary .....
☐ **ID** Indonesia
☐ **IL** Israel .....
☐ **IN** India .....
☐ **IS** Iceland
☒ **JP** Japan .....
☐ **KE** Kenya .....
☐ **KG** Kyrgyzstan .....
☐ **KP** Democratic People's Republic of Korea .....
☐ **KR** Republic of Korea .....
☐ **KZ** Kazakhstan .....
☐ **LC** Saint Lucia
☐ **LK** Sri Lanka
☐ **LR** Liberia
☐ **LS** Lesotho .....
☐ **LT** Lithuania
☐ **LU** Luxembourg
☐ **LV** Latvia
☐ **MA** Morocco .....
☐ **MD** Republic of Moldova .....
☐ **MG** Madagascar .....
☐ **MK** The former Yugoslav Republic of Macedonia .....
☐ **MN** Mongolia
☐ **MW** Malawi .....
☐ **MX** Mexico .....
☐ **NO** Norway
☐ **NZ** New Zealand .....
☐ **PL** Poland .....
☐ **PT** Portugal .....
☐ **RO** Romania
☐ **RU** Russian Federation .....
☐ **SD** Sudan
☐ **SE** Sweden
☐ **SG** Singapore
☐ **SI** Slovenia .....
☐ **SK** Slovakia .....
☐ **SL** Sierra Leone .....
☐ **TJ** Tajikistan .....
☐ **TM** Turkmenistan .....
☐ **TR** Turkey .....
☐ **TT** Trinidad and Tobago .....
☐ **TZ** United Republic of Tanzania
☐ **UA** Ukraine .....
☐ **UG** Uganda .....
☒ **US** United States of America .....
☐ **UZ** Uzbekistan .....
☐ **VN** Viet Nam .....
☐ **YU** Yugoslavia .....
☐ **ZA** South Africa .....
☐ **ZW** Zimbabwe .....

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ .....
☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

	Filing date of earlier application (day month year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1)	14.08.1999 14th August 1999	9919159.5	GB		
item (2)					
item (3)					

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s):

** Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*

ISA /

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority)*:

Date *(day month year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:	4
description (excluding sequence listing part)	:	19
claims	:	3
abstract	:	1
drawings	:	
sequence listing part of description	:	
Total number of sheets	:	27

This international application is **accompanied by** the item(s) marked below:

1. ☐ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other *(specify)*:

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Keith W Nash & Co, Agents

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's file reference: HCM/C295.01/I

Applicant: Imperial Chemical Industries PLC

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE . . . . . 55.00 T

2. SEARCH FEE . . . . . 605.00 S

International search to be carried out by _____

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 27 sheets.

first 30 sheets b1

_____ (remaining sheets) x _____ (additional amount) = b2

Add amounts entered at b1 and b2 and enter total at B . . . . 264.00 B

Designation Fees

The international application contains 3 designations.

3 (number of designation fees payable *(maximum 8)*) x 56 (amount of designation fee) = 168.00 D

Add amounts entered at B and D and enter total at I . . . . . 432.00 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT *(if applicable)* . . . . . 22.00 P

5. TOTAL FEES PAYABLE 1114.00

Add amounts entered at T, S, I and P, and enter total in the TOTAL box: TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

- ☐ authorization to charge deposit account (see below)
- ☒ cheque
- ☐ postal money order
- ☐ bank draft
- ☐ cash
- ☐ revenue stamps
- ☐ coupons
- ☐ other *(specify)*:

DEPOSIT ACCOUNT AUTHORIZATION *(this mode of payment may not be available at all receiving Offices)*

The RO/ _____

☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ *(this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit)* is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

Deposit Account No. _____ Date *(day month year)* _____ Signature _____

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

3

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
HCM/C295.01/I		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02794	20/07/2000	14/08/1999
International Patent Classification (IPC) or national classification and IPC B41M7/00		
Applicant IMPERIAL CHEMICAL INDUSTRIES PLC et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17/11/2000	28.11.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Spyropoulou, E Telephone No. +49 89 2399 2843

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02794

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-19 as originally filed

Claims, No.:

1-20 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-6,13-17
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-20
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

V.

a). From EP-A-0917964 (D1), a thermal transfer medium comprising a substrate and a thermally transferable overlay material said overlay material comprising a polyester (aromatic polycarbonate resin) having a Tg greater than 80°C and a molecular weight between 5000 and 100000 (see D1, page 5 line 6-10 and page 6 lines 19-24).

A polycarbonate is a polyester of carbonic acid with aliphatic or aromatic dihydroxy compounds (see The Penguin Dictionary of Chemistry, 2nd ed., page 320).
A polycarbonate is a linear polyester of carbonic acid and can be formed from any dihydroxy compound and any carbonate diester, or by ester interchange (See Hawley's: Condensed Chemical Dictionary, 12th ed., page 931).

A UV light absorber is also comprised in the coating of overlay material disclosed in the thermal transfer medium of D1 (see page 7 lines 16-18).

A thermal transfer medium according to claims 1-6, a thermal transfer medium according to claim 13, a method of making said thermal transfer medium according to claim 14, a method of forming an overlay on a receiver material according to claims 15 and 16 and a receiver material bearing said overlay according to claim 17 are known from D1 and therefore not novel.

In view of the teaching of D1, as well as the other available citations, dependent claims 7 -12 and 18-20 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step.

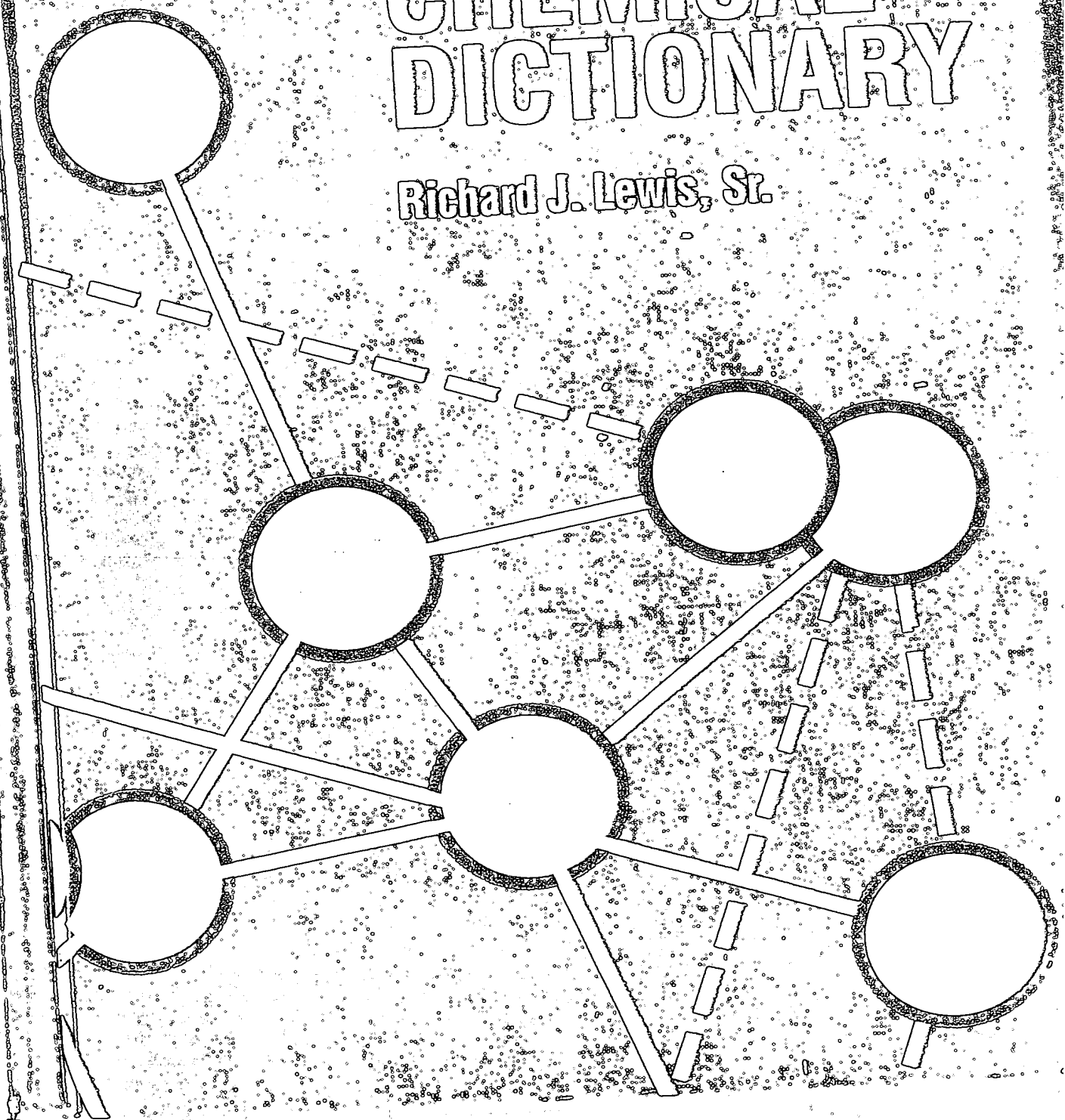
VII.

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 is not mentioned in the description, nor is this document identified therein.

Hawley's CONDENSED CHEMICAL DICTIONARY

Twelfth Edition

Richard J. Lewis, Sr.



polyisobutene to which has been added 2% of isoprene, which provides sulfur linkage sites for vulcanization. Isobutene can be homopolymerized to various degrees in chains containing from 10 to 1000 units, the viscosity increasing with molecular weight. Combustible.
See also "Vistanex."
Use: Lubricating-oil additive, hot-melt adhesives, sealing tapes, special sealants, cable insulation, polymer modifier, viscosity index improvers, films and coatings.

polybutylene terephthalate. An engineering plastic derived from 1,4-butanediol, it is a thermoplastic polyester with a broad spectrum of uses.

polycarbonate. $(COOC_6H_5C(CH_3)_2C_6H_5O)_n$.
A synthetic thermoplastic resin derived from bisphenol A and phosgene, it is a linear polyester of carbonic acid and can be formed from any dihydroxy compound and any carbonate diester, or by ester interchange. Polymerization may be in aqueous emulsion or in nonaqueous solution.
Properties: Transparent (90% light transmission), noncorrosive, weather- and ozone-resistant, nontoxic, stain-resistant, combustible but self-extinguishing, low water absorption, high impact strength, heat-resistant, high dielectric strength, dimensionally stable, soluble in chlorinated hydrocarbons and attacked by strong alkalies and aromatic hydrocarbons, stable to mineral acids, insoluble in aliphatic alcohols. Excellent for all molding methods, extrusion, thermoforming, etc.; easily fabricated by all methods including thermoforming and fluidized bed coating.
Use: Molded products, solution-cast or extruded film, structural parts, tubes and piping, prosthetic devices, meter face plates, nonbreakable windows, street-light globes, household appliances.

polycarboxylic acid. An organic acid containing two or more carboxyl (COOH) groups.

polychlor. General name for synthetic chlorinated hydrocarbons.
Use: Pesticides.

polychlorinated biphenyl. (PCB).
CAS: 1336-36-3. One of several aromatic compounds containing two benzene nuclei with two or more substituent chlorine atoms. They are colorless liquids with d 1.4–1.5. Because of their persistence, toxicity, and ecological damage via water pollution their manufacture was discontinued in the U.S. in 1976.
Hazard: Highly toxic.

polychloroprene. See neoprene.

polychlorotrifluoroethylene. (PCTFE). See chlorotrifluoroethylene polymer.

"Polyco" [*Borden*]. TM for a series of thermoplastic polymers in the form of water emulsions or solvent solutions, applied to vinyl acetate polymers and copolymers, butadiene-styrene copolymer latics, polystyrenes, vinyl and vinylidene chloride copolymers, acrylic copolymers and water-soluble polyacrylates.
Use: Adhesives and coatings, in paint, leather, textiles, paper, cosmetics, and construction fields.

polycondensation. See condensation (1); polymerization.

polycoumarone resin. See coumarone-indene resin.

polycyclic. An organic compound having three or more aromatic nuclei in it structure which may be the same or different, e.g., anthracene, naphthacene.
See polynuclear.

poly(1-4-cyclohexylenedimethylene)terephthalate. TM "Kodel." A linear polyester film or fiber obtained by condensation of terephthalic acid with 1,4-cyclohexanedimethanol. It has good electrical resistivity and hydrolytic stability.
Use: Carpet fibers and chemically resistant films.
See also terephthalic acid.

"Polycyclol 1222" [*Union Carbide*]. TM for an intermediate for the preparation of alkyd-type resins used for coatings. These are known by the coined name "cyclyd."

poly-1,1-dihydroperfluorobutyl acrylate.
Properties: White, rubber-like polymer. D 1.5, begins to degrade at 148C, retains strength and elastomeric properties in contact with synthetic lubricants, solvents, hydraulic fluids, oils, etc. at temperatures in the range 148–204C, has limited flexibility at temperatures below −17C. Non-flammable.
Use: O-rings, seals, gaskets, diaphragms, hose, sheets and coatings for fabrics and other surfaces.

polydimethylsiloxane. (PDMS). A silicone polymer developed for use as a dielectric coolant and in solar energy installations. It also may have a number of other uses. It is stated to be highly resistant to oxidation and to biodegradation by microorganisms. It is degradable when exposed to a soil environment by chemical reaction with clays and water, by which it is decomposed to silicic acid, carbon dioxide, and water.

Title: THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER

Field of the Invention

This invention relates to thermal transfer printing and concerns a thermal transfer medium, a method of making the medium, a method of forming an overlay on a receiver material and the resulting receiver material bearing an overlay.

Background to the Invention

Dye diffusion thermal transfer printing is a well known process in which one or more thermally transferable dyes are transferred from selected areas of a dyesheet to a receiver material by localised application of heat, thereby to form an image. Full colour images can be produced in this way using dyes of the three primary colours, yellow, magenta and cyan. Mass transfer printing is another well known technique in which colorant material (commonly carbon black) is transferred from a mass transfer medium to a receiver material by localised application of heat. Mass transfer printing is generally used to print monochrome images, commonly text, bar codes etc. Dye diffusion thermal transfer printing and mass transfer printing are often used in conjunction with one another, with a common application being the printing of personalised cards such as identification cards, credit cards, driving licences etc, bearing a full colour image of the head of a person and text and/or a bar code in monochrome (usually black). Such printing is conveniently carried out using a dye sheet in the form of an elongate strip or ribbon of a heat-resistant substrate, typically polyethylene terephthalate film, carrying a plurality of similar sets of different coloured dye coats and colorant, each set comprising a panel of each dye colour (yellow, magenta and cyan) and a panel of colorant, with the panels being in the form of discrete stripes extending transverse to the length of the ribbon, and arranged in a repeated sequence along the length of the ribbon.

The resulting prints, particularly those in the form of cards, are frequently carried in plastic pouches, but plasticisers in the pouches are a particular problem because they are generally good solvents for thermal transfer dyes. A heavily plasticised PVC pouch, for example, can

extract virtually all the colour from an unprotected image. As a result it has become common practice to provide a layer of protective overlay material over prints produced in this way. The overlay makes the printed card or other material more secure by giving the image some degree of protection against abrasion and attack by plasticisers.

Overlay material is conveniently applied by thermal mass transfer, and to this end a ribbon-like dye sheet as described above conveniently also includes a panel of mass transfer overlay material in each set, downstream of the dye panels and colorant panel.

For overlay material to perform satisfactorily the material should have both good printability and good protective properties. For good printability the material should have good transfer characteristics, which require the material to fracture easily during the printing process, giving clean edges and a continuous coating of the printed overlay material. If the material does not fracture easily during printing the material instead tends to tear or rupture, producing images with jagged or ragged edges, exhibiting a phenomenon known as flashing. For good protective properties, the overlay should be flexible and durable and capable of withstanding rough treatment and hostile environments, such as elevated temperatures, particularly when carried in plastic pouches. To impart these properties, the overlay material needs to be tough and remain effectively continuous during prolonged use.

The requirements for good printability and good protective properties are difficult to reconcile in a single material.

Current commercially available overlay material achieves the transfer characteristics and durability requirements of the protective overlay by three different main routes. One method provides a thin layer of protective overlay (<1μm quoted, but more commonly about 0.2μm) of a very strong durable polymer, containing a high loading of a small particulate filler (US 5387573). A second method uses a multi-layer overlay comprising of a layer to aid release from the dyesheet substrate; a brittle, tough, durable polymer layer which has low adhesion to the receiver material; and an adhesion promoting layer to allow the protective layer to adhere to the receiver material (US 4977136). Another method uses a thick polymer layer of a very tough, durable polymer material which would normally have an unacceptable level of

flashing, with a very high loading of an ultra-violet light absorbing (UVA) filler material to achieve a lightfast overlay, with a low cohesive strength to allow good transfer (WO 98/07578).

Summary of the Invention

According to the present invention there is provided a thermal transfer medium comprising a substrate bearing on at least part of one surface thereof a coating layer of a thermally transferable overlay material for transfer onto a thermal transfer image formed on a receiver material, wherein the coating layer comprises polyester having a Tg greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The polyester preferably has a Tg of at least 75°C.

Suitable commercially available polyesters include Skybon ES600-H (Skybon is a Trade Mark) from S K Chemicals, which has a Tg of about 80°C and a molecular weight of about 7,000, and Vylon GXW27 (Vylon is a Trade Mark) from Toyobo, which has a Tg of about 77°C and a molecular weight of about 7,500. Both of these materials are hydroxyl-terminated polyester resins. The polyester thus conveniently comprises a hydroxy-terminated polyester resin. In one embodiment the polyester has a Tg of about 80°C and a molecular weight of about 7,000 and in another the polyester has a Tg of about 77°C and a molecular weight of about 7,500. In these embodiments the polyester may be a hydroxy-terminated polyester resin.

Mixtures of suitable polyesters may be used.

By using a polyester having Tg and molecular weight characteristics as specified, it is surprisingly found that an overlay material in the form of a single layer of material (in contrast to multi-layer overlays of the prior art) which is highly transparent and has good transfer characteristics coupled with good barrier properties and durability can be provided.

The coating suitably has a thickness in the range 0.5 to 5.0 μm, preferably 1.5 to 3.5 μm, typically 1.6 to 2.0 μm.

Various additives may optionally be included in the coating, eg to enhance or add properties in known manner.

For example, filler materials such as inorganic filler eg silica (SiO_2), alumina (Al_2O_3) and titanium dioxide (TiO_2) can be used to lower the cohesive strength of the polymer layer to aid transfer, but also to improve durability and prevent 'blocking' (ie sticking) of the printed overlay to other materials such as card wallets. Optical brighteners (OB) eg Uvitex OB (from Ciba Geigy) (Uvitex is a Trade Mark) may be used to improve the colour of printed cards, as a tamper-proof measure in the overlay, and to aid registration in the film coating process. Ultra-violet light absorbers (UVA) eg Tinuvin (from Ciba Geigy) (Tinuvin is a Trade Mark) can be used to give protection to both the overlay to reduce yellowing, and an underlying dye diffusion print to reduce fading upon exposure to ultra-violet (UV) light.

The substrate may be any suitable heat-resistant material such as those known in the art. Suitable substrate materials include films of polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane. Biaxially oriented polyester film, particularly polyethylene terephthalate (PET), is currently favoured for its properties of mechanical strength, dimensional stability and heat resistance. The substrate suitably has a thickness in the range 1 to 20μm, preferably 2 to 10μm, typically about 6μm.

The thermal transfer medium preferably includes a subcoat between the substrate and coating, particularly in the form of a releasing subcoat to assist release of the coating during printing. One preferred release subcoat comprises a crosslinked acrylic coating.

The thermal transfer medium desirably includes a heat-resistant backcoat, on the side of the substrate not carrying the coating, to resist applied heat in use in known manner.

The thermal transfer medium is conveniently in the form of a ribbon for use in thermal transfer printing, comprising a substrate having on one surface thereof a plurality of repeated

sequences of dye coats and mass transfer materials in the form of discrete stripes extending transverse to the length of the ribbon.

Thus in a preferred aspect the invention provides a thermal transfer medium, comprising an elongate strip of substrate materials having on one surface thereof a plurality of similar sets of thermally transferable dye coats and mass transfer layers, each set comprising a respective coat of each dye colour, yellow, magenta and cyan, and a respective mass transfer layer for colorant and overlay, each coat or layer being in the form of a discrete stripe extending transverse to the length of the substrate, with the sets arranged in a repeated sequence along the length of the substrate, wherein each overlay material mass transfer layer comprises a coating of an overlay material comprising polyester having a glass transition temperature (Tg) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The thermal transfer medium is conveniently made by dissolving or dispersing the overlay material in a suitable solvent as is well known in the art to give a coating liquid. Suitable solvents include methyl ethyl ketone (MEK), propanone, tetrahydrofuran, toluene, cyclohexanone etc. The coating liquid is then coated on the substrate and dried in known manner eg by bar coating, blade coating, air knife coating, gravure coating, roll coating, screen coating, fountain coating, rod coating, slide coating, curtain coating, doctor coating.

In a further aspect the invention provides a method of making thermal transfer medium, comprising forming on one surface of a substrate a coating of an overlay material comprising polyester having a glass transition temperature (Tg) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The thermal transfer medium is used in known manner for forming an overlay on a receiver material, frequently coupled with printing an image on suitable receiver material. The receiver material is typically in the form of a sheet or card of paper, cardboard, plastics material etc having a suitable image-receiving surface. The thermal transfer medium is placed in contact with the receiver material and localised heating effected to cause localised transfer of overlay material to form a protective overlay, commonly preceded by thermal transfer printing of dyes to produce a full colour image and mass transfer of colorant to

produce text, a barcode etc, on the receiver material. One common use of the thermal transfer medium is in production of identification cards, typically formed on a sheet of plastics material such as polyvinyl chloride, ABS and polyester, and which may bear a full colour photograph of the head of an individual, produced by thermal transfer printing, in combination with text and/or a bar code produced by mass transfer printing of colorant, and covered with a layer of overlay material.

The invention finds particular application for use with receiver material in the form of a card of PVC with an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer, and also with synthetic laminated paper receivers and voided polyester receivers.

In a further aspect the invention provides a method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with the invention and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.

The invention also includes within its scope the receiver material bearing an overlay produced in this way, particularly an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

The receiver material may optionally carry a further protective overlay (of similar or different constitution to the main overlay) on the opposed face.

The invention will be further described, by way of illustration, in the following examples.

Example 1 (comparative)

A coating solution (solution A) was prepared from

Vylon GK640	30% by weight	(Tg = 79°C / MWt. = 20,000)
manufactured by Toyobo		
MEK	70% by weight	

A coating was applied by hand using a Meier bar to give a wet coat about 6μm thick, onto a 6μm thick polyester substrate base film. The base film was already coated with a heat resistant backcoat to provide protection from a thermal head during the printing process, and subcoat comprising a cross-linked acrylic system subcoat to provide release of the coating during printing. The coating was dried initially by a hair drier, then in an oven at 110°C. for 30 seconds. The dry coat thickness was about 2.8μm.

The subcoat comprises a highly cross-linked acrylic coating in which the cross-linking is achieved by UV-curing using a combination of photoinitiators and synergists included in the subcoat composition, details of which are given below. The subcoat was coated on the polyester to give a dry coat thickness of approximately 0.5μm. The subcoat composition, expressed as % w/w, was as follows:

Chemical	% Composition	Manufacturer
MIBK	47.02%	Alcohols LTD
Uvecryl E1354	41.88%	UCB Radcure S.A
Diakon MG102	5.98%	KDT / Distrupol
Irgacure 907	1.68%	Ciba Geigy Plastics
Uvecryl P101	1.67%	UCB Radcure S.A
Quantacure ITX	0.84%	Lambson Fine Chemicals
Quantacure EPD	0.84%	Lambson Fine Chemicals
Cyan dye	0.08%	

MIBK is methyl iso-butyl ketone. This is the solvent from which the subcoat layer is deposited. The solvent is evaporated from the coating before it is subjected to UV-curing.

Uvecryl E1354 is a hexafunctional aromatic urethane acrylate oligomer. (Uvecryl is a Trade Mark.)

Diakon MG102 is a high molecular weight grade of poly methylmethacrylate. (Diakon is a Trade Mark.)

Irgacure 907, Uvecryl P101, Quantacure ITX & Quantacure EPD catalyse UV-curing of the Uvecryl E1354. (Irgacure, Uvecryl and Quantacure are Trade Marks.)

The resulting coating was spliced into a ribbon of dyesheet and was used to print onto a receiver comprising a card of polyvinyl chloride (PVC). The surface of the PVC card consists predominantly of a vinyl chloride/vinyl acetate copolymer (approximately 95:5 ratio, respectively). Printing was carried out using a Fargo Pro card printer (Fargo Pro is a Trade Mark) (manufactured by FARGO Electronics Incorporated).

The protective overlay was assessed for print transfer quality which showed very severe flashing and incomplete coverage of the PVC card. No cards were tested due to the un-acceptable transfer characteristics.

Example 2 (comparative)

A coating solution (solution B) was prepared from

Vylon GK130	30% by weight (Tg = 15°C / MWt. range = 5,000 - 8,000)
manufactured by Toyobo	
MEK	70% by weight

A coating was applied as described in Example 1.

When the material was cut to size for splicing into a ribbon of dyesheet the samples all 'blocked' together into a clump of dyesheet, with each piece of dyesheet 'welded' to the piece above in the stack.

No cards were printed for testing.

Example 3

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight (Tg = 77°C / MWt. range = 7,500)

MEK	70% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 2.9μm. The protective overlay was assessed for print transfer quality. The overlay has sharp clean edges and the coating is continuous over the printed area of card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay is equivalent or better than currently commercially available material. Test details are given below.

Example 4

A coating solution (solution D) was prepared from

Skybon ES600-H	30% by weight (Tg = 80°C / MWt. range = 7,000)
MEK	70% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.2μm. The protective overlay was assessed for print transfer quality. The overlay has sharp clean edges and the coating is continuous over the printed area of card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay is equivalent or better than currently commercially available material, with the exception of lightfastness where the polymer only overlay yellowed with exposure to UV light. Further testing with the inclusion of UVAs and OBs significantly reduced the yellowing of the overlay when exposed to UV light.

Example 5

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight (Tg = 77°C / MWt. range = 7,500)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a voided polyester receiver (CP15 Olmec Secure from ICI Imagedata – Olmec is a Trade Mark) using a CP15 printer (manufactured by Mitsubishi). The dry coat thickness was about 2.9μm. The coating was assessed for transfer quality, which appeared very good. Further prints were made and tested for wallet barrier resistance (2), dye bleed and security properties. Test details are given below. In all tests performed the protective overlay is equivalent or better than currently commercially available material, with the exception of the dye bleed test, where the protective overlay allowed slightly more dye bleed than currently commercially available material (which allows slight dye bleed).

Example 6

A coating solution (solution D) was prepared from

Skybon ES600-H	30% by weight (Tg = 80°C / MWt. range = 7,000)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a voided polyester receiver (CP15 Olmec Secure) using a CP15 printer (manufactured by Mitsubishi). The dry coat thickness was about 3.2μm. The coating was assessed for transfer quality, which appeared very good. Further prints were made and tested for wallet barrier resistance (2), dye bleed and security properties. In all tests performed the protective overlay is equivalent or better than currently commercially available material.

Example 7

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight (Tg = 77°C / MWt. range = 7,500)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a laminated paper receiver (CP700 Olmec Secure from ICI Imagedata) using a CP700 printer (manufactured by Mitsubishi) fitted with an HX EPROM. The dry coat thickness was about 2.9μm. The coating was assessed for transfer quality, which appeared very good.

Example 8

A coating solution (solution D) was prepared from

Skybon ES600-H	30% by weight (Tg = 80°C / MWt. range = 7,000)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a laminated paper receiver (CP700 Olmec Secure from ICI Imagedata) using a CP700 printer (manufactured by Mitsubishi) fitted with an HX EPROM. The dry coat thickness was about 3.2μm. The coating was assessed for transfer quality, which appeared very good.

Example 9

A coating solution was prepared from

Vylon GXW27	25% by weight (Tg = 77°C / MWt. range = 7,500)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight

Uvitex OB (optical brightener	
- Ciba Geigy	0.13% by weight
MEK	74.37% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.1μm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 10

A coating solution was prepared from

Vylon GXW27	25% by weight (Tg = 77°C / MWt. range = 7,500)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight
Uvitex OB (optical brightener	
- Ciba Geigy)	0.13% by weight
Aerosil MOX80 (silica filler - Degussa)	1.25% by weight
MEK	73.12% by weight.

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.1μm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 11

A coating solution was prepared from.

Skybon ES600-H	25% by weight (Tg = 80°C / MWt. range = 7,000)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight
Uvitex OB (optical brightener - Ciba Geigy)	0.13% by weight
MEK	74.37% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.1μm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 12

A coating solution was prepared from.

Skybon ES600-H	25% by weight (Tg = 80°C / MWt. range = 7,000)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight
Uvitex OB (optical brightener - Ciba Geigy)	0.13% by weight
Aerosil MOX80 (silica filler - Dugussa)	1.25% by weight
MEK	73.12% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 2.9μm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Test Methods

Durability (1) - Taber Abrasion

The object of this test is to simulate the everyday abrasive wear to the protective overlay on the PVC card surface which may be expect throughout the lifetime of the card.

After printing the card with a special optical density (OD) image designed for test purposes, with protective overlay as described in the Examples, the card is notched along the centre of the low optical density long edge of the card to allow the card to be mounted as one of a pair of test cards on the turntable of the Taber 5130 Abrader (Taber is a Trade Mark) (manufactured by Teledyne Taber) which wears down the surface of the card with two abrasive rubber wheels under a specific load, driven by the sample in opposite directions.

The other card of the test pair is printed with a currently commercially available protective overlay. The card pair is then abraded for 100 cycles using CS-10F wheels, 1kg extra weight and a 70% vacuum level.

The performance of the development protective overlay is then be graded against the commercially available material.

Good samples will show no loss of image but the protective overlay will be scuffed; poor samples will have worn completely through to the card surface.

Durability (2) - Tumble Test

The object of this test is to simulate everyday wear of a card, including handling, flexing, heat and humidity, and abrasion.

After printing with an optical density image (as used in the Taber test) and protective overlay (as described in the Examples), cards are flexed 100 times along the length of the card (image extension) using a testing machine referred to as an AutoFlexer machine. The AutoFlexer machine comprises of a pair of jaws, one fixed the other free to move in a forwards/backwards motion. A motor drives the jaws with a movement of 12mm and a closed gap of 41mm with the cards flexing in the short direction (the set up may by altered to flex the cards in the long direction with a closed gap of 55mm). The jaws can accommodate a maximum of 4 test cards. The cards are flexed at 0.5 Hz.

After applying Veriderm cream (a hand cream designed to simulate natural finger grease, manufactured by Upjohn) (Veriderm is a Trade Mark) to the imaged surface, the card is placed in a 45°C/85%RH (relative humidity) oven for 24 hours. The cards are then placed around the inside surface of a cylindrical container (with the image facing inwards) filled with a selection of nuts and bolts (to simulate pocket change, keys, etc.). The lid of the container is then sealed and the container is tumbled on a set of rollers at a speed of about 20 rpm for two hours. The cards are then removed, wiped clean of any excess grease, and graded according to the level of damage to the card surface, as compared to currently commercially available material.

Good samples will show no loss of image but the protective overlay may be scuffed; poor samples will have worn completely through to the card surface.

Wallet Barrier (1)

After printing with an optical density image (as used in the Taber test) and protective overlay (as described in the Examples), cards are flexed 100 times along the length of the card

(image extension) using the AutoFlexer machine. The flexed region of the card is examined by optical microscope and a print made of any damage visible. A piece of the internal surface of a PVC card wallet (as commonly used to clip an id card to clothing) is placed over the imaged surface of the card, which is then placed under a 1.2kg mass in a 50°C oven for 72 hours. Unflexed cards are also tested to indicate whether any dye bleed is due to insufficient barrier properties of the protective overlay or to fracturing of the protective overlay during flexing. The samples are removed from the oven, separated and graded according to the extent of dye bleed through the protective overlay onto the PVC wallet, as compared to currently commercially available material.

Good samples will have no dye bleed on to the PVC wallet material; poor samples will show dye bleed even on unflexed cards.

Lightfastness

After printing with an optical density image (as used in the Taber Test) and protective overlay (as described in the Examples), cards are measured using a MacBeth TR 1224 densitometer (manufactured by MacBeth Division of Kollmorgen Instruments Corporation) (MacBeth is a Trade Mark). The samples are then placed in an Atlas Ci35 Fade-ometer (manufactured by Atlas Electric Devices Company) (Atlas and Fade-ometer are Trade Marks) for exposure to:-

1.5w/m^2 measured at 420nm
290J/m^2 measured at 420nm
50%RH

The cards are then re-measured and the percent optical density loss recorded, and graded for % OD loss and a visual assessment as compared to currently commercially available material.

Good samples will be visibly brighter and more vibrant, with a low % OD loss measured; poor samples will be visibly faded in conjunction with a high % OD loss measured.

Wallet Barrier (2)

After printing with a suitable image and protective overlay, the printed surface is placed in contact with plasticised PVC wallet material, under a 1.2kg mass in a 45°C/85%RH oven for 15 days. The samples are removed from the oven, separated and graded according to the extent of dye bleed through the protective overlay onto the PVC wallet material, as compared to currently commercially available material. No dye should be seen to bleed onto the PVC wallet material.

Dye Bleed

The overlay was designed to protect the dye diffusion image from low molecular weight, migratable materials, resident in lamination overlay adhesives. These materials, should they enter the receiver layer, would cause the dyes to move, fuzzing out the detail in the photographs. This test assesses the effectiveness of the overlay to protect the image from the adhesive migratables.

Two prints of four passport size portraits images with protective overlay are made. An adhesive thermal indicator strip is placed on an unprinted area of the receiver, and HMSO approved laminate is placed over both the imaged area and thermal indicator strip.

Test laminates incorporating thermal indicator strips are made to verify that the lamination conditions are with 99 - 104°C; then test prints are laminated.

The two prints are placed in an oven set to 80°C for 96 hours (4 days).

To pass the test there must be no visible degradation of the image after ageing.

Security Test

A single portrait image is cut from a print of four passport sized portrait images with protective overlay, and the printed image is secured using double sided adhesive tape to a

piece of paper card. HMSO approved laminate is applied over the printed image and card, having previously made test laminates incorporating thermal indicator strips to verify the lamination conditions of 99 - 104°C.

Once cool the laminate around the print is cut using a scalpel.

The laminate is peeled slowly back, by hand, away from the print through 180°. To pass the test the damage to the imaged surface must be such that neither the print or laminate can be re-used.

Summary of Results

Grading system

2 much better than current commercially available material
1 better than current commercially available material
0 as current commercially available material
-1 worse than current commercially available material
-2 much worse than current commercially available material

Example Ref	Transfer	Taber	Tumble	Wallet Barrier (1)	Light fastness	Wallet Barrier (2)	Dye Bleed	Security
1	-2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	0	0	0	1	1	n/a	n/a	n/a
4	0	0	0	1	1	n/a	n/a	n/a
5	0	n/a	n/a	n/a	n/a	0	-1	0
6	0	n/a	n/a	n/a	n/a	0	1	0
7	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a

8	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9	0	0	0	1	1	n/a	n/a	n/a
10	0	0	0	1	1	n/a	n/a	n/a
11	0	0	0	1	1	n/a	n/a	n/a
12	0	0	0	1	1	n/a	n/a	n/a

Claims

1. A thermal transfer medium comprising a substrate bearing on at least part of one surface thereof a coating layer of a thermally transferable overlay material for transfer onto a thermal transfer image formed on a receiver material, wherein the coating layer comprises polyester having a Tg greater than 50°C and a molecular weight in the range 6,000 to 10,000.

2. A thermal transfer medium according to claim 1, wherein the polyester has a Tg of at least 75°C.

3. A thermal transfer medium according to claim 1 or 2, wherein the polyester has a Tg of about 80°C and a molecular weight of about 7,000.

4. A thermal transfer medium according to claim 1 or 2, wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.

5. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises filler material.

6. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises one or more ultra-violet light absorbers.

7. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises one or more optical brighteners.

8. A thermal transfer medium according to any one of the preceding claims, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.

9. A thermal transfer medium according to any one of the preceding claims, wherein the coating has a thickness in the range 0.5 to 5.0μm, preferably 1.5 to 3.5μm, typically 1.6 to 2.0μm.

10. A thermal transfer medium according to any one of the preceding claims, further comprising a subcoat between the substrate and coating.

11. A thermal transfer medium according to claim 11, comprising a cross-linked acrylic subcoat.

12. A thermal transfer medium according to any one of the preceding claims, wherein the other surface of the substrate has a heat-resistant backcoat.

13. A thermal transfer medium, comprising an elongate strip of substrate material having on one surface thereof a plurality of similar sets of thermally transferable dye coats and mass transfer layers, each set comprising a respective coat of each dye colour, yellow, magenta and cyan, and a respective mass transfer layer for colorant and overlay, each coat or layer being in the form of a discrete stripe extending transverse to the length of the substrate, with the sets arranged in a repeated sequence along the length of the substrate, wherein each overlay material mass transfer layer comprises a coating of an overlay material comprising polyester having a glass transition temperature (Tg) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

14. A method of making a thermal transfer medium, comprising forming on one surface of a substrate a coating of an overlay material comprising polyester having a glass transition temperature (Tg) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

15. A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with any one of claims 1 to 13 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.

16. A method according to claim 15, further comprising producing a printed image on the receiver material by thermal transfer printing prior to formation of the overlay.

17. Receiver material bearing an overlay produced by the method of claim 15 or 16.

18. Receiver material according to claim 17, comprising a card of polyvinyl chloride.

19. Receiver material according to claim 17 or 18, wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.

20. Receiver material according to claim 17, 18 or 19, in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
C295.01/I		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/ 02794	20/07/2000	14/08/1999
Applicant		
IMPERIAL CHEMICAL INDUSTRIES PLC et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. ----

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figur better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

Intern[redacted] Application No
PCT/GB 00/02794

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B41M7/00 B42D15/10 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B41M B42D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, WPI Data, EPO-Internal, IBM-TDB, CHEM ABS Data, PAPERCHEM, PIRA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 917 964 A (DAINIPPON PRINTING COMPANY LIMITED) 26 May 1999 (1999-05-26) page 3, line 6 -page 4, line 5 page 4, line 29 - line 46; figures 1-6 page 6, line 19; claims 1-9	1,2,5-20
A	WO 98 07578 A (IMPERIAL CHEMICAL INDUSTRIES PLC) 26 February 1998 (1998-02-26) cited in the application page 1, line 1 - line 3 page 4, line 7 - line 23 claims 1-8	1-20
A	US 5 332 713 A (M.C.S.OLDFIELD ET AL.) 26 July 1994 (1994-07-26) column 2, line 3 - line 60; table 1 column 9, line 35 - line 47; claims 1-20	1-20

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 September 2000	09/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bacon, A

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 849 092 A (EASTMAN KODAK COMPANY) 24 June 1998 (1998-06-24) page 2, line 51 -page 3, line 12 claims 1-10	1-20
A	EP 0 295 485 A (EASTMAN KODAK COMPANY) 21 December 1988 (1988-12-21) page 2, line 29 - line 36; example 3 page 11, line 29 -page 12, line 31 claims 1-5	1-20

INTERNATIONAL SEARCH REPORT

In. ..nat...on patent family members

Internat... Application No
PCT/G... 00/02794

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